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1-0. INTRODUCTION.

25X1D [redacted]

25X1D [redacted] Requirements of the system, and design methods proposed to meet these requirements, have been outlined in previous reports. This report describes the status of the system and the progress made during October.

1-2. During the period covered by this report, modifications have continued on the breadboard model, primarily with respect to the airborne receiver. Some of the assemblies in the receiver have been fixed in design and have entered the prototype stage.

2-0. ANTENNA.

2-1. As a continuation of experimental studies on possible antenna configurations, several forms of flat spirals were tested. The results were not suited to the present application because the impedance of such configurations had too large a ratio of reactance to resistance, and because the antenna pattern was too sensitive to frequency changes.

2-2. The tests made on the various types of antennas resulted in the development of a flush antenna that appears to exhibit near-optimum pattern and impedance characteristics over the
25X1D frequency range [redacted] Pattern measurements were made on a 1/27th scale model, and the impedance measurements were made on a 1/2 scale model prototype. When a 50-ohm coaxial line is connected to the antenna, a standing wave ratio of about six to one results. Although this mismatch results in a signal loss of only about 3 db, a mismatch at the input r-f causes a deterioration in noise figure and also introduces the possibility of self-oscillation. It appears possible to reduce the maximum standing-wave ratio over the band to three to one by means of a matching network consisting of lumped-constant elements. Circuit-synthesis methods are being applied in an attempt to solve this problem.

3-0. R-F ASSEMBLY.

3-1. A new oscillator circuit has been developed to replace the first local oscillator. Whereas the original r-f head employed a germanium-diode first mixer and a double-triode crystal oscillator, the new circuit uses a single-triode first mixer, and a single-triode crystal oscillator. In addition to reducing the number of components, an improvement in the stability of the mixer output impedance and a reduction of spurious signal generation is effected in this way. This new oscillator has been successfully operated at 125°C. An etched-board layout of the r-f head for the prototype unit is now being developed.

3-2. The wide-band r-f preamplifier is being laid out for the prototype fabrication.

4-0. <u>I-F ASSEMBLY.</u>

4-1. Several changes have been made on the i-f assembly. These changes were made to reduce spurious signals and to comply with military specifications. The operating frequency of the third i-f amplifier has been raised from one mc to 1.5 mc. The manufacture of the i-f transformers to comply with military specifications has been arranged with the Automatic Manufacturing Corporation. The second i-f amplifier, which formerly included two single-tuned resonant circuits, has been changed by replacing the single-tuned circuits with two double-tuned transformers. These double-tuned transformers have a center frequency of 18 mc, and have been satisfactorily temperature-tested.

4-2. The changes indicated above, plus other minor changes, have resulted in a considerable improvement of circuit performance. However, further improvements are still indicated and the present plan is to decrease the second i-f amplifier frequencies from 18 mc to 16 and to increase the selectivity of the first i-f amplifier by adding two more tuned circuits.

5-0. <u>SECOND LOCAL-OSCILLATOR ASSEMBLY.</u>

5-1. The circuit design of this assembly has been frozen, and the drawing of the etched-board layout is nearing completion. The prototype model of the assembly can be constructed when the etched board has been fabricated.

6-0. <u>THIRD LOCAL-OSCILLATOR ASSEMBLY.</u>

6-1. Changes in this assembly include the replacement of the one-mc booster amplifier with a d-c amplifier and the addition of a rapid-agc discharge circuit. The rapid-agc discharge circuit makes it possible for the receiver to return quickly to full sensitivity when the lock-on interval ends. This reduces the possibility of losing signals which are adjacent to strong, steady carriers. Experimental work has been started on the circuit which will eliminate the problem of frequency drift in the reactance-tube oscillator which forms the third local oscillator.

This circuit employs a quartz-crystal marker at each end of the 350-kc sweep range. The reactance-tube output frequency is held between these markers by a pulse feedback circuit.

7-0. RECEIVER POWER SUPPLY. A breadboard model of the receiver power supply has been completed and tested. A 400-cycle three-phase alternator has been procured so that the varying speed conditions of the actual installation can be simulated in the laboratory. The variable-speed drive for this alternator is presently being planned and will be assembled soon.

8-0. RECEIVER PACKAGING AND A NEW APPROACH TO THE PROBLEM OF EQUIPMENT COOLING.

8-1. Many of the details of receiver packaging have been worked out. Each receiver assembly will have individual electrical shielding and in addition, the entire receiver will have lightweight dust covers.

8-2. The various receiver assemblies will plug into an aluminum plate which forms the core of the receiver case. Heat will be conducted away from the receiver assemblies and to the aluminum plate by means of metal brackets connecting the assemblies to the aluminum plate. The aluminum plate, in turn, is joined to a removable metal panel which is set flush with, and forms a part of the outer skin of the aircraft. In this way, air moving past the removable metal panel will carry off heat generated by the receiver circuitry. Since equipment cooling depends on the motion of the aircraft, during ground tests the equipment will have to be cooled by means of a ground-based apparatus.

8-3. The new method of equipment cooling offers the following major advantages:

a. Reduces airborne equipment weight and space requirements by eliminating the need for carrying cooling equipment in the aircraft.

b. Conserves cabin air.

c. The equipment is easily accessible because the entire receiver can be removed from the outside of the aircraft by removing the outside metal plate to which the receiver is attached.

9-0. SUMMARY. The major effort continues to be directed toward completing the airborne equipment. Although work is being continued on the breadboard model, the designs of a number of the assemblies have been firmed and have entered the prototype stage. Work will continue on the conversion of breadboard assemblies into prototype form.